Yellowknife X4 User's Manual

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5/13/98

Revision 1.0

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1 OVERVIEW

1.1 REVISION HISTORY

Date	Revision	Distribution	Comments
5/13/98	1.0	General Release	for Motherboard version X4

Please send your comments of this user's manual to:

RISC Hotline
Phone: 512-895-4488
Email: risc10@email.sps.mot.com

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This document contains information on a new product under development. Specifications and information herein are subject to change without notice.

1.2 INTRODUCTION

This user's manual defines the features of a PowerPC 6xx/7xx evaluation system, code-named "Yellowknife X4".

Before system power on, check the system with the packing list. If any items are missing, please call your local Motorola sales office.

The design philosophy behind Yellowknife was to create a very modular, full-featured evaluation system that could be easily tailored by the users to meet their specific requirement. Key features are:

- Easy processor upgrade through PGA ZIF socket
- Selectable operating frequencies
- ATX form factor motherboard allows full size PCI and ISA add-on cards

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1.3 PURPOSE

The Yellowknife X4 evaluation system has various uses including, but not limited to :

- System for use by customers in benchmarking, compatibility testing, RTAS customization and firmware development.
- System suitable to showcase the 6xx and 7xx PowerPC processors, as well as the MPC106 Chipset.
- Software debugs platform for embedded application.
- Development platform for use by third-parties firmware/utility developers.

1.3 REFERENCE DOCUMENTS

1.3.1 Motorola Documents

- PowerPC Microprocessor Family: The Programming Environments manual
- PowerPC 603e Users manual
- PowerPC 750 User's manual
- PowerPC 106 User's manual

1.3.2 External Documents

- IBM AT Technical Reference Manual
- Peripheral Component Interconnect (PCI) Specification Rev 2.1
- ATX Specification version 1.0

2 PRODUCT SUMMARY

The following is a summary of the major features of Yellowknife:

Processor and Chipset support

- Processors supported: all 6xx and 7xx processor with external bus frequencies up to 100 MHz
- One PGA (Socket 3) connector on board
- MPC106 Processor to PCI bridge
- Winbond 83C553 as PCI to ISA bridge

Memory support

- 2 64-bit (168-pin) DIMM sockets
- 8 MB minimum, 128 MB maximum SDRAM
- Support for 8 MB, 16 MB , 32 MB and 64MB DIMMs
- 512K pipelined L2 cache on board
- Flash EPROM for boot firmware

Peripheral support

- Three PCI slots
- Two ISA slots
- Two serial ports (buffered, 16550-compatible)
- One DB25 parallel port
- Two IDE connectors
- PS/2 keyboard port
- PS/2 mouse port
- Floppy interface

Chassis

- ATX size chassis with ATX power supply

Software

- DINK32 Debug Monitor Software

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3 SYSTEM CONFIGURATION

- PowerPC 603, 740 or 750 Microprocessor
- ATX chassis with ATX power supply
- 32 MB DIMM
- On board 512 KB Pipelined L2 Cache
- DINK32 debug monitor ROM

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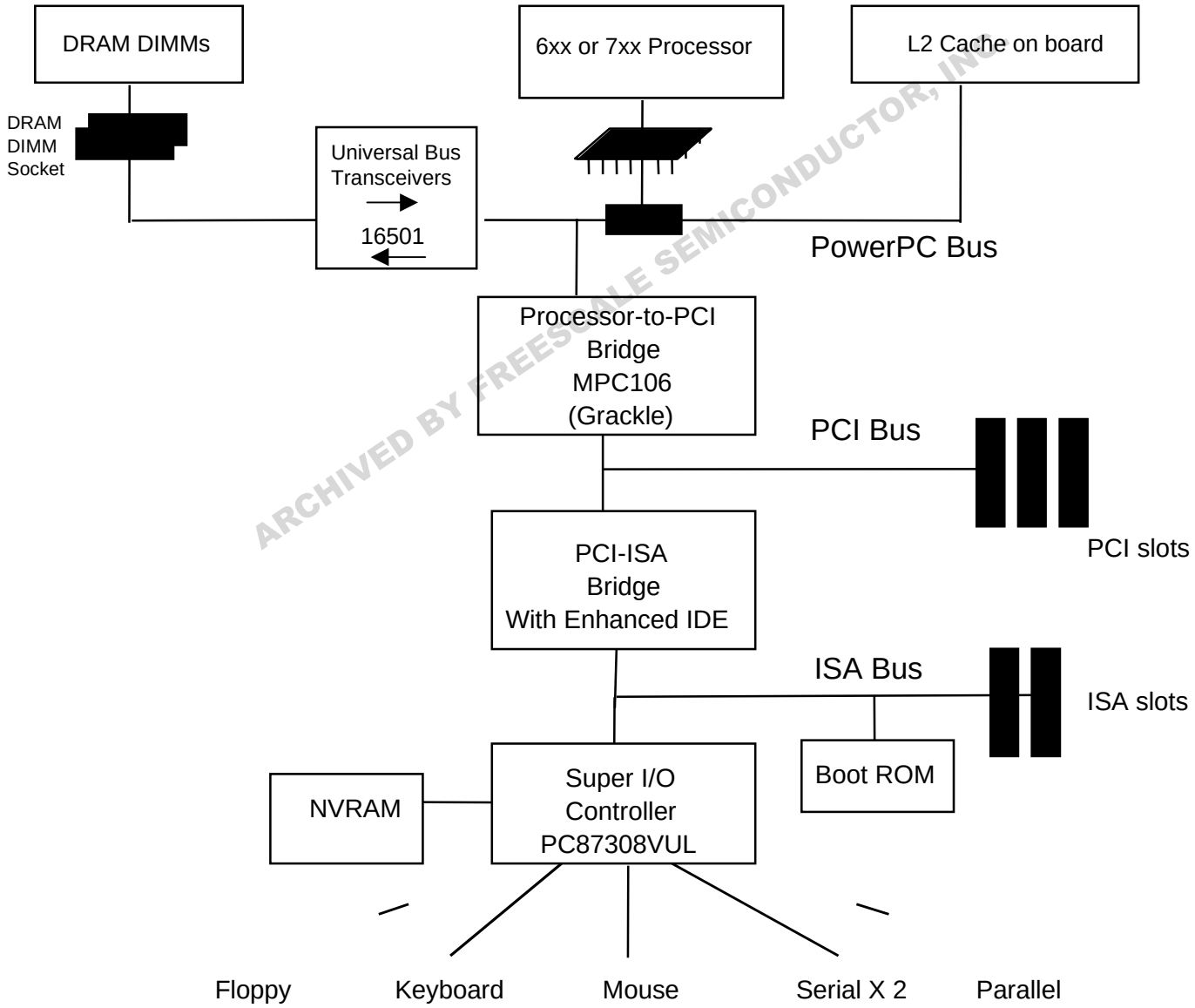
3.1 BLOCK DIAGRAM

The following is the block diagram of the Yellowknife X4 configuration:



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4 CHASSIS

4.1 CHASSIS

Standard PC I/Os is supported in Yellowknife. The Yellowknife uses the ATX format chassis which has drive bay to accomodate an additional hard drive.

4.2 SLOTS

The Yellowknife chassis supports a total of five I/O slots for add-in cards. Three of the slots support PCI cards and the remaining two support ISA cards.

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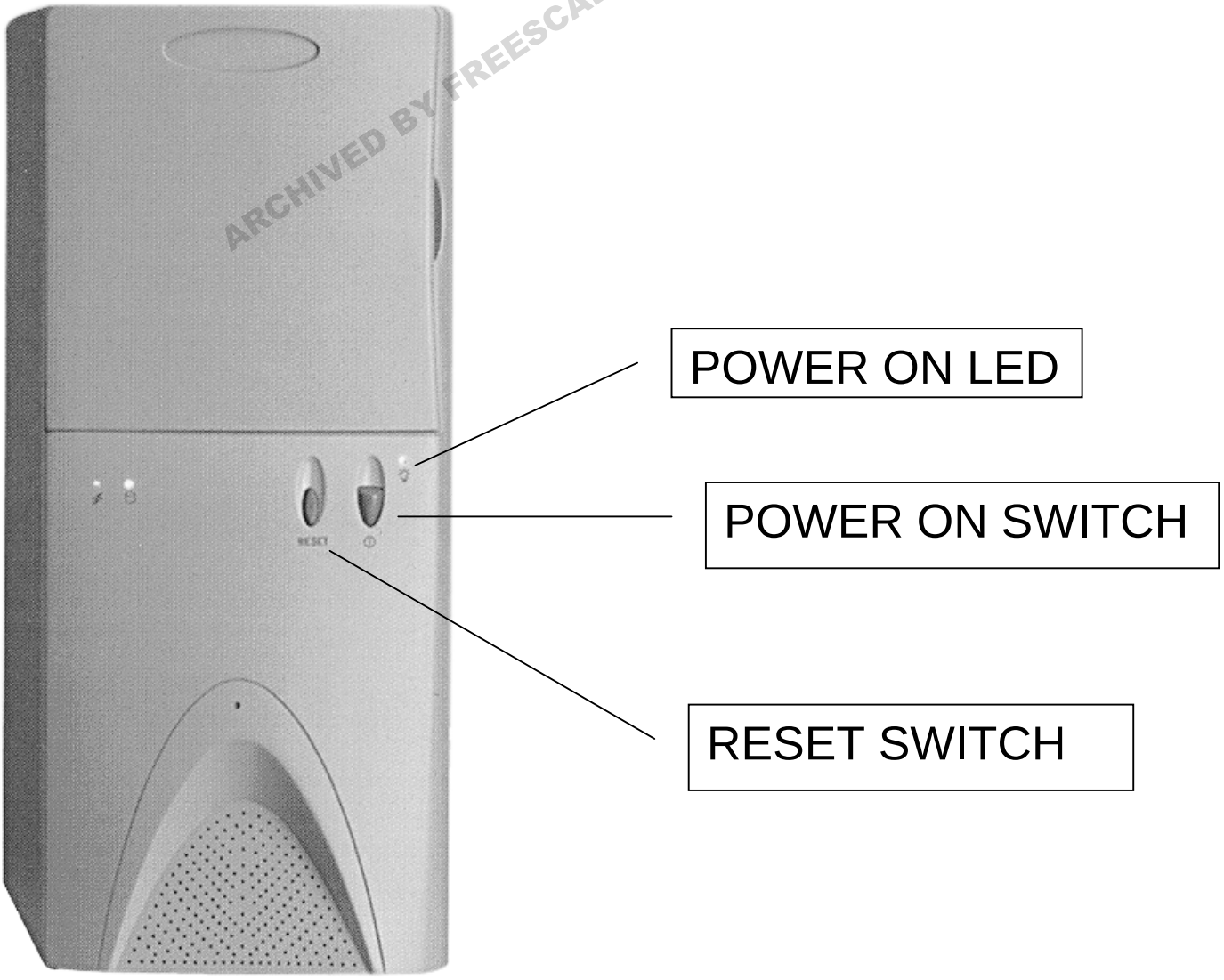
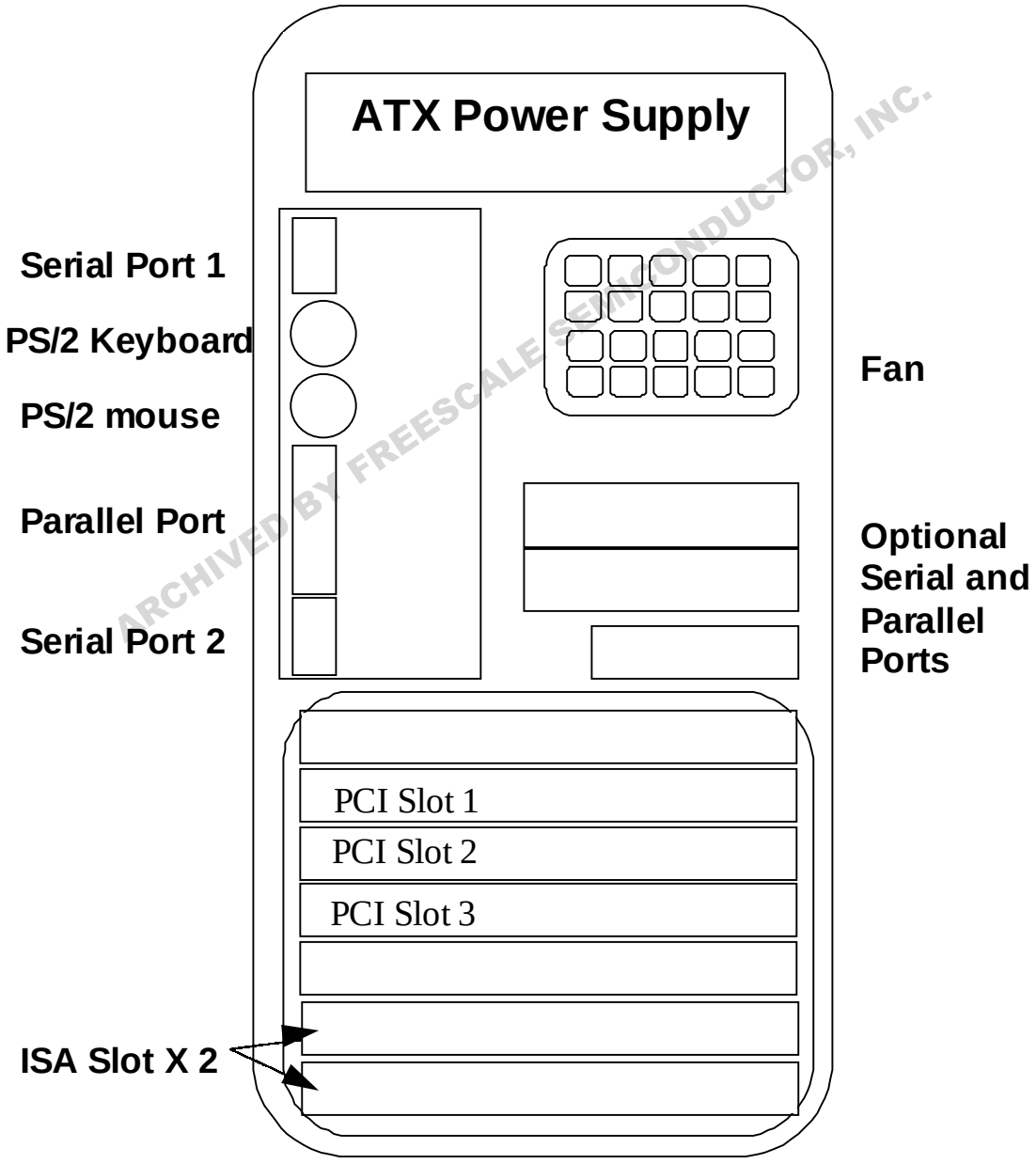
4.3 EXTERNAL CONTROLS & INDICATORS

The following diagram shows the front panel of the Yellowknife system:



4.4 EXTERNAL CONNECTORS

The following show the back panel on the ATX chassis:



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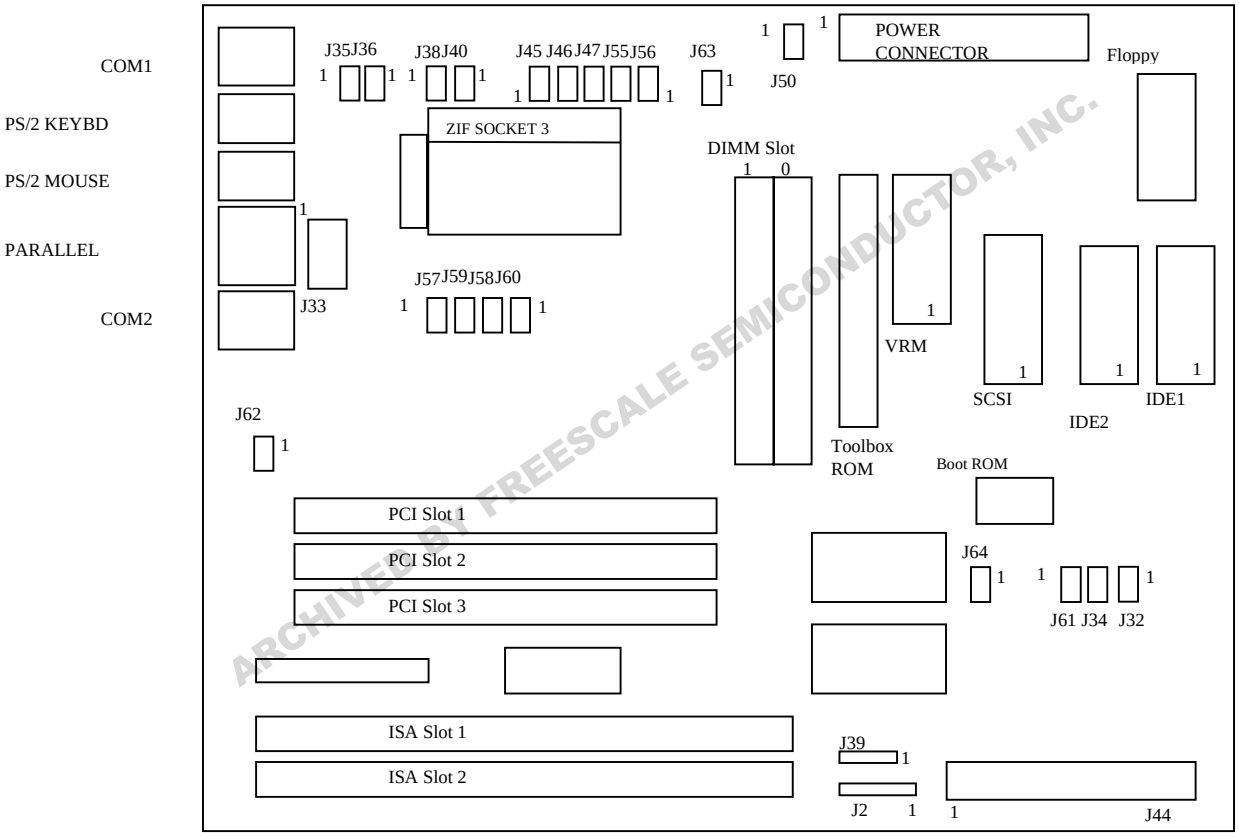
5 INSTALLATION

5.1 MOTHERBOARD DIAGRAM

The following is the Yellowknife x4 motherboard diagram:



Jumpers and connectors Description

1)	J39	COP Enable Mode (3-pin)
2)	J61	System bus speed selector FREQO (2-pin)
3)	J34	System bus speed selector FREQ1(2-pin)
4)	J32	System bus speed selector FREQ2 (2-pin)
5)	J35	Internal processor bus selector PLL0 (3-pin)
6)	J36	Internal processor bus selector PLL1 (3-pin)
7)	J38	Internal processor bus selector PLL2 (3-pin)
8)	J40	Internal processor bus selector PLL3 (3-pin)
9)	J57	MPC106 bus speed selector GPLL0 (2-pin)
10)	J59	MPC106 bus speed selector GPLL1 (2-pin)
11)	J58	MPC106 bus speed selector GPLL2 (2-pin)
12)	J60	MPC106 bus speed selector GPLL3 (2-pin)
13)	J2	CMOS Battery connector (3-pin)
14)	J45,46,47,55,56	VID override jumper (3-pin)
15)	J64	Interrupt routing jumper (3-pin)
16)	J63	Test Support Jumper (3-pin)
17)	J44	Misc. connectors for Reset,speaker, LEDs, Power switch....
18)	J50	CPU Fan Power Connector (3-pin)
19)	J33	ESP connector (2x8-pin)

5.2 JUMPERS, SLOTS AND CONNECTORS

5.2.1 Jumpers

1) J39	p.14	COP Enable Mode (3-pin)
2) J63	p.14	Test Support Jumper (3-pin)
3) J64	p.14	Interrupt routing jumper (3-pin)
4) J61	p.15	System bus speed selector FREQO (2-pin)
5) J34	p.15	System bus speed selector FREQ1(2-pin)
6) J32	p.15	System bus speed selector FREQ2 (2-pin)
7) J35	p.15	Internal processor bus selector PLL0 (3-pin)
8) J36	p.15	Internal processor bus selector PLL1 (3-pin)
9) J38	p.15	Internal processor bus selector PLL2 (3-pin)
10) J40	p.16	Internal processor bus selector PLL3 (3-pin)
11) J57	p.16	MPC106 bus speed selector GPLL0 (2-pin)
12) J59	p.16	MPC106 bus speed selector GPLL1 (2-pin)
13) J58	p.16	MPC106 bus speed selector GPLL2 (2-pin)
14) J60	p.16	MPC106 bus speed selector GPLL3 (2-pin)
15) J45,46,47,55,56	p.17	VID override jumper (3-pin)

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5.2.2 Connectors

1) PS/2 Keyboard	p.17	PS/2 keyboard connector (6 pin)
2) PS/2 Mouse	p.17	PS/2 mouse connector (6-pin)
3) Serial Port	p.18	Serial Port COM1 & COM2 (9-pin)
4) Parallel Port	p.19	Parallel Port LPT1 (25-pin)
5) Power Connector	p.20	ATX power supply connector (20-pin)
6) IDE Connector	p.21	IDE connectors(40-pin)
7) Floppy	p.22	Floppy Drive connector (34-pin)
8) J2	p.22	CMOS Battery connector (3-pin)
9) J44	p.23	Misc. connectors for Reset,speaker, LEDs, Power switch....
10) J50	p.23	CPU Fan Power Connector (3-pin)
11) J33	p.24	ESP connector (2x8-pin)
12) VRM Module	p.25	VRM module connector (2x15-pin)
13) J62		Test Clock connector (2-pin) (For testing only)

5.2.3 Additional Connectors / Sockets

1) DIMM slots	p.26	DRAM Memory DIMM socket
2) ROM socket	p.26	ROM Socket for Boot ROM
3) ZIF Socket 3	p.29	Socket for PowerPC Processor (PGA)
4) ISA slots	p.30	16-bit ISA slots
5) PCI slots	p.32	32-bit PCI Bus Expansion slots

5.3 INSTALLATION PROCEDURE

Before Power on the Yellowknife system, please make sure the followings:

1) All Jumpers are set correctly
2) DRAM Modules in place
3) PowerPC processor is installed correctly
5) Cables, wires and Power Supply are connected correctly
6) DINK32 software setup correctly

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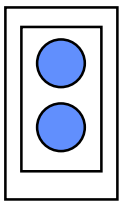
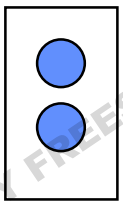
5.3.1 Jumpers

The Yellowknife board jumpers discussed in these sections are either 2-pin or 3 pin arrays. Two settings are possible for 2-pin array:

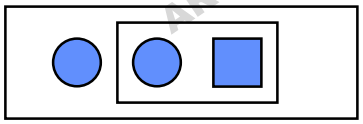


short



Open

For the 3-pin array, the following diagram shows the setting for 1-2. Pin 1 of each jumper is labeled on the system board

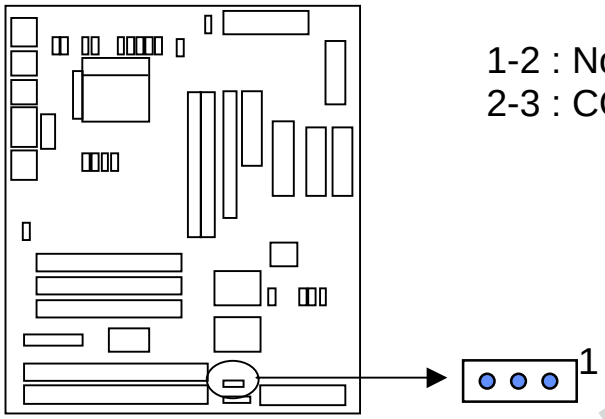


Setting 1-2

1

5.3.1.1 Jumper Settings

5.3.1.1.1 J39 COP Enable Mode (3-pin)



1-2 : Normal
2-3 : COP Mode

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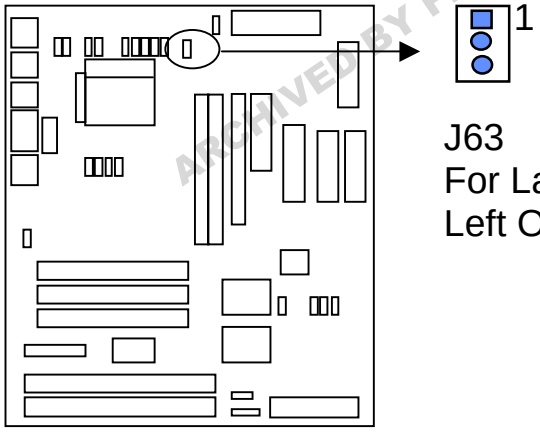
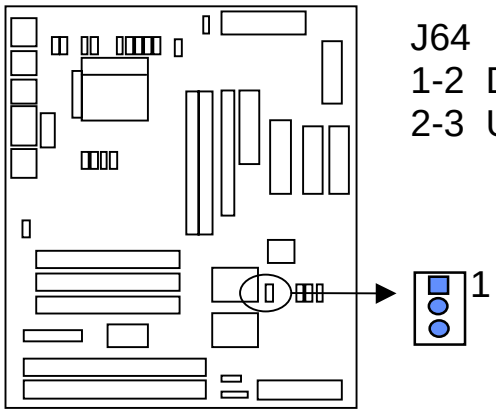
5.3.1.1.2 J63 Test Support Jumper (3-pin)



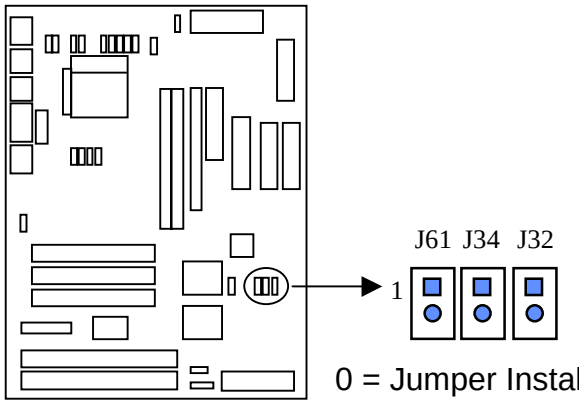
J63
For Lab Testing Only
Left Open

5.3.1.1.3 J64 Interrupt routing Jumper (3-pin)



J64
1-2 Do not populate
2-3 Using 8259 for interrupt controller (Default)

5.3.1.1.4 J61, J34, J32 System Bus speed selector (2-pin)



0 = Jumper Installed
1 = Jumper Not Installed

System Clock Setting

J61	J34	J32	Bus Freq.	PCI Freq.
0	0	0	50	25
0	0	1	60	30
0	1	0	66	33
0	1	1	75	37
1	0	0	83	33
1	0	1	90	36
1	1	0	99	39

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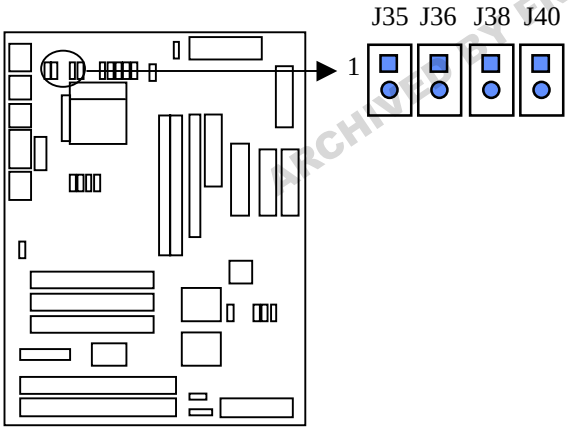
5.3.1.1.5 J35, J36, J38, J40 Processor Speed selector (2-pin)



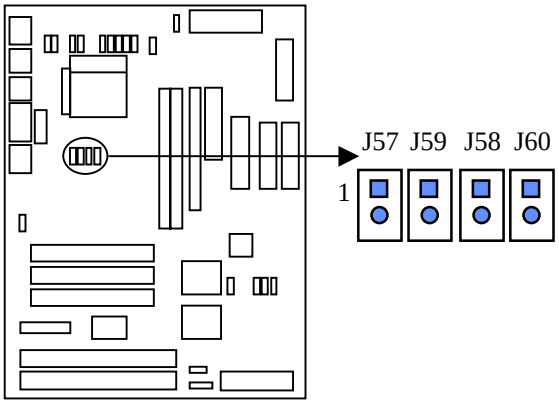
0 = Jumper Installed
1 = Jumper Not

Processor PLL Settings

J35	J36	J38	J40	Bus Multi	Bus Clock
0	0	0	0	7x	25-33
0	0	0	1	-	-
0	0	1	0	-	-
0	0	1	1	Bypass	
0	1	0	0	2x	60-83
0	1	0	1	6.5x	25-40
0	1	1	0	2.5x	50-83
0	1	1	1	4.5x	33-60
1	0	0	0	3x	40-83
1	0	0	1	5.5x	25-40
1	0	1	0	4x	33-66
1	0	1	1	5x	25-50
1	1	0	0	-	-
1	1	0	1	6x	25-40
1	1	1	0	3.5x	40-75
1	1	1	1	-	-

Notes: Please refers to the user's manual for more detail on the PLL setting.

5.3.1.1.6 J40, J57, J59, J58 MPC106 bus speed selector (GPLL)(2-pin)



0 = Jumper Installed
1 = Jumper Not

MPC106 PLL Settings

J57	J59	J58	J60	Bus Clock	PCI Clock
0	0	0	0	-	-
0	0	0	1	1x	33
0	0	1	0	1x	16-25
0	0	1	1	Bypass	
0	1	0	0	2x	66
0	1	0	1	2x	33-50
0	1	1	0	2.5x	83
0	1	1	1	2.5x	41-50
1	0	0	0	3x	75-100
1	0	0	1	3x	50
1	0	1	0	-	-
1	0	1	1	-	-
1	1	0	0	-	-
1	1	0	1	-	-
1	1	1	0	-	-
1	1	1	1	OFF	-

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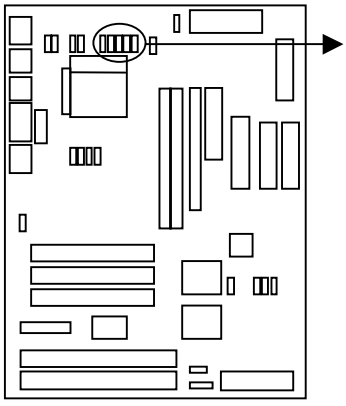
5.3.1.1.7 J45, J46, J47, J55, J56 VID override Jumper (3-pin)



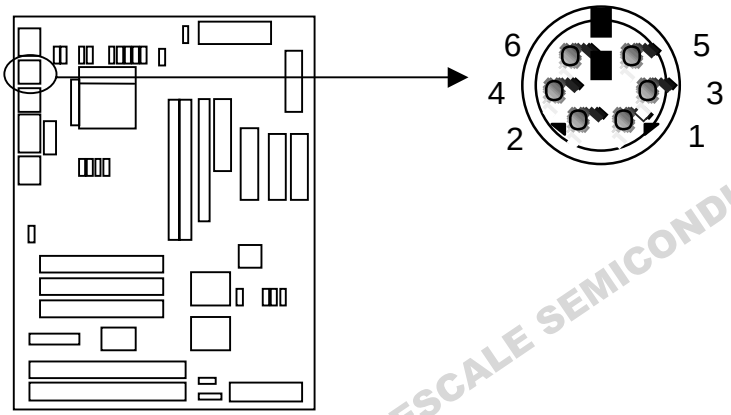
WARNING:

These jumpers are for testing purpose only. Please do not populate these jumpers! Populate any of these Jumpers may cause the system malfunctions.

5.3.2 Connectors

5.3.2.1 PS/2 Keyboard and mouse

Yellowknife supports both the AT-compatible keyboard interfaces. PS/2 keyboard connectors are located at the back panel .



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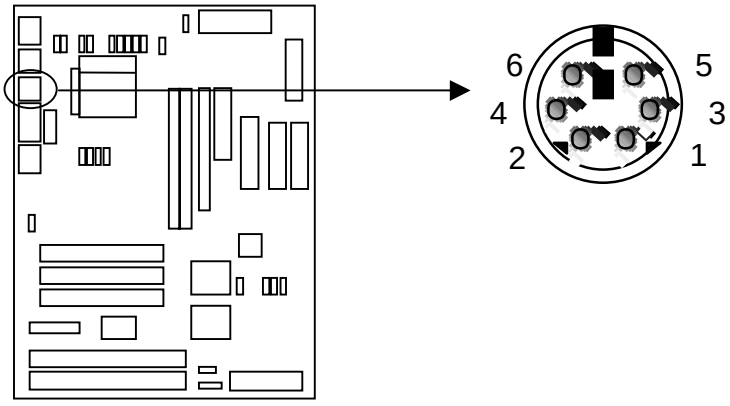
The following is the PS/2 keyboard pin definition:

Pin	Signal	I/O	Definition
1	KBDATA	I/O	Keyboard data
2	NC	N/A	No connection
3	GND	N/A	Signal GND
4	FVcc	N/A	Fused supply voltage
5	KBCLK	I/O	Keyboard clock
6	NC	N/A	No connection
Shell	N/A	N/A	Chassis GND

Yellowknife supports both the PS/2 compatible mouse The PS/2 mouse is supported through the mouse port . PS/2-mouse connector is located at the back panel .
PS/2 mouse connector pin assignment



Pin	Signal	I/O	Definition
1	MFDATA	I/O	Mouse data
2	NC	N/A	No connection
3	GND	N/A	Signal GND
4	FVcc	N/A	Fused supply voltage
5	KBCLK	I/O	Mouse clock
6	NC	N/A	No connection
Shell	N/A	N/A	Chassis GND

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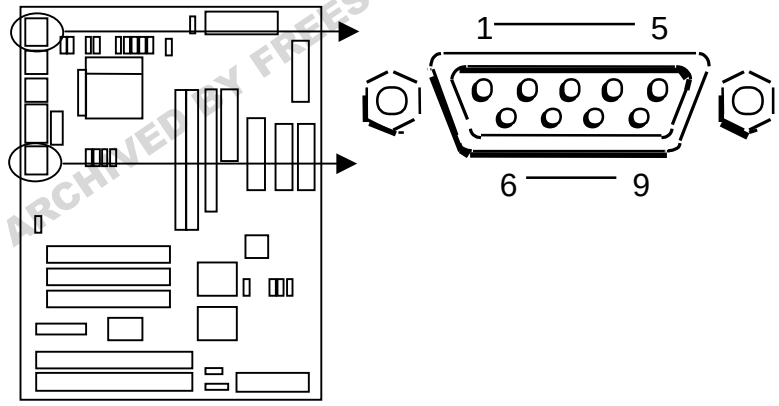
5.3.2.2 Serial Ports

Yellowknife has two 16550-compatible serial ports. PC serial connectors are located at the back panel.

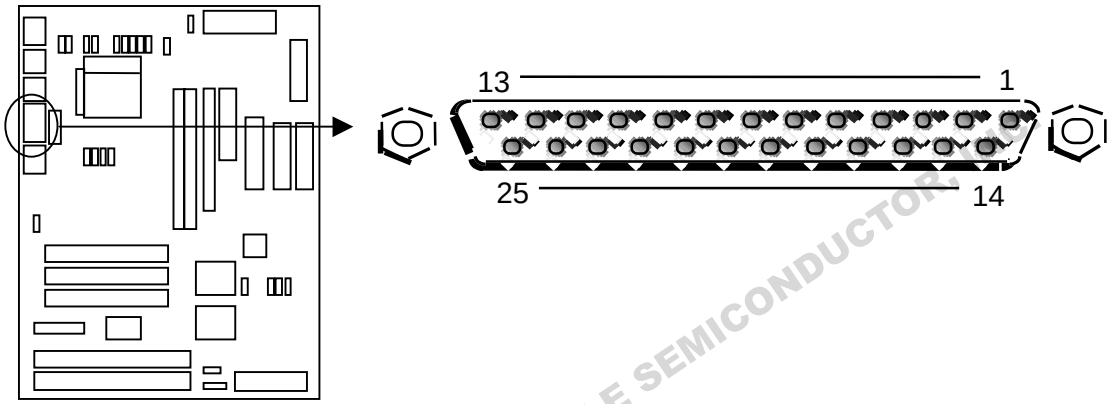
PC serial port pin assignment



Pin	Signal	I/O	Definition
1	DCD	I	Data carrier detect
2	SIN	I	Serial input
3	SOUT	O	Serial output
4	DTR	O	Data terminal ready
5	GND	N/A	Signal GND
6	DSR	I	Data Set Ready
7	RTS	O	Request To Send
8	CTS	I	Clear To Send
9	RI	I	Ring Indicator

5.3.2.3 Parallel Port

Yellowknife has one AT-compatible, bi-directional parallel port. This connector is located at the back panel.



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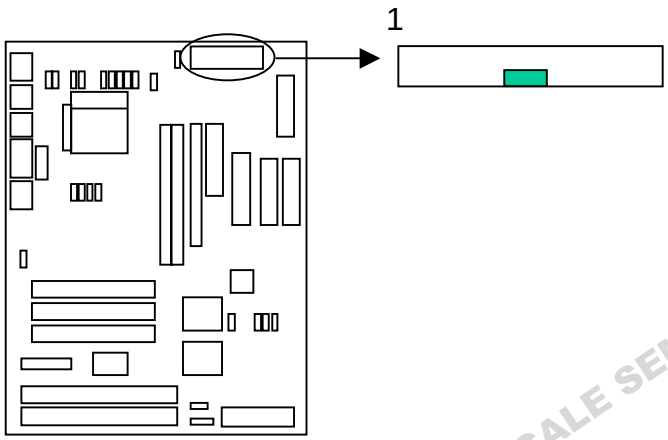
Pin	Signal	I/O	Definition
1	STB#	I/O	Strobe
2	PD0	I/O	Printer data bit o
3	PD1	I/O	Printer data bit 1
4	PD2	I/O	Printer data bit 2
5	PD3	I/O	Printer data bit 3
6	PD4	I/O	Printer data bit 4
7	PD5	I/O	Printer data bit 5
8	PD6	I/O	Printer data bit 6
9	PD7	I/O	Printer data bit 7
10	ACK#	I	Acknowledge
11	BUSY	I	Busy
12	PE	I	Paper end
13	SLCT	I	Select
14	AFD#	O	Automatic Feed
15	ERR#	I	Error
16	INIT#	O	Initialize printer
17	SLIN#	O	Select in
18-25	GND	N/A	Signal GND

5.3.2.4 Power Connector

Yellowknife uses the standard ATX power supply which provide the 5V and 3.3V to the motherboard. The following is the power connector pin assignment:



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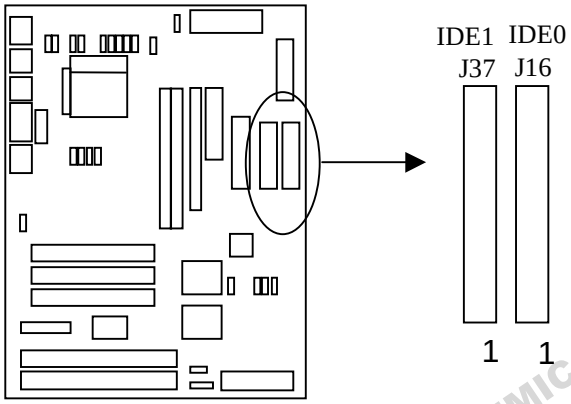
Pin	Signal	Pin	Signal
1	+3.3V	11	+3.3V
2	+3.3V	12	-12V
3	GND	13	GND
4	VCC	14	PS_ON
5	GND	15	GND
6	VCC	16	GND
7	GND	17	GND
8	PWRGOOD	18	-5V
9	VSTDBY	19	VCC
10	+12V	20	VCC

5.3.2.5 IDE Connectors

The Enhanced IDE controller is built in the PCI-ISA Bridge, two IDE connectors are on the motherboard to support both the enhanced IDE hard drives and the IDE CD-ROM.



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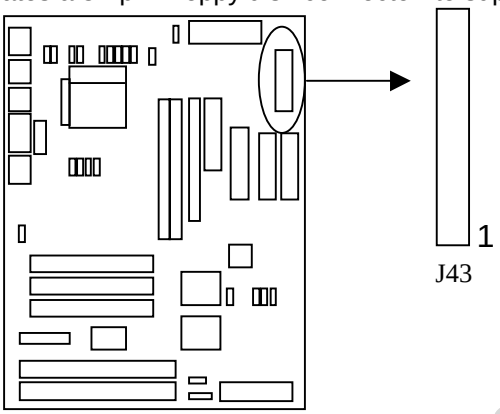
IDE connector pin assignment

Pin	Signal	Pin	Signal
1	IDERESET#	2	GND
3	IDED7	4	IDED8
5	IDED6	6	IDED9
7	IDED5	8	IDED10
9	IDED4	10	IDED11
11	IDED3	12	IDED12
13	IDED2	14	IDED13
15	IDED1	16	IDED14
17	IDED0	18	IDED15
19	GROUND	20	N.C.
21	IDEDRQ#	22	GND
23	IDEIOW#	24	GND
25	IDEIOR#	26	GND
27	N/C	28	IDEBALE
29	IDEACK#	30	GND
31	IDEIRQ	32	IDEIOCS16#
33	IDESA1	34	N.C.
35	IDESA0	36	IDESA2
37	IDECS0#	38	IDECS1#
39	DISKLED#	40	GND

5.3.2.6 Floppy Disk Connector

Yellowknife incorporates a 34-pin Floppy disk connector to support the floppy disk drive .



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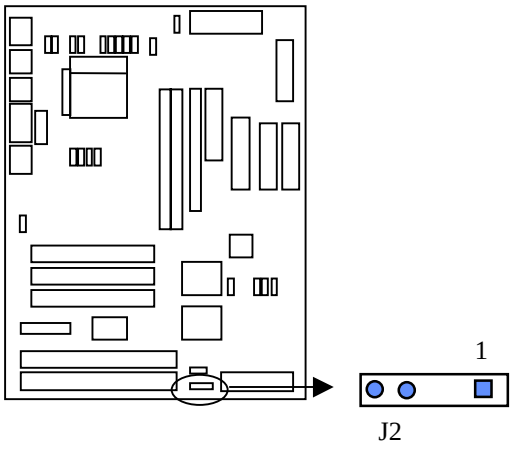
The pin assignment of the autoeject floppy disk drive is as follows:

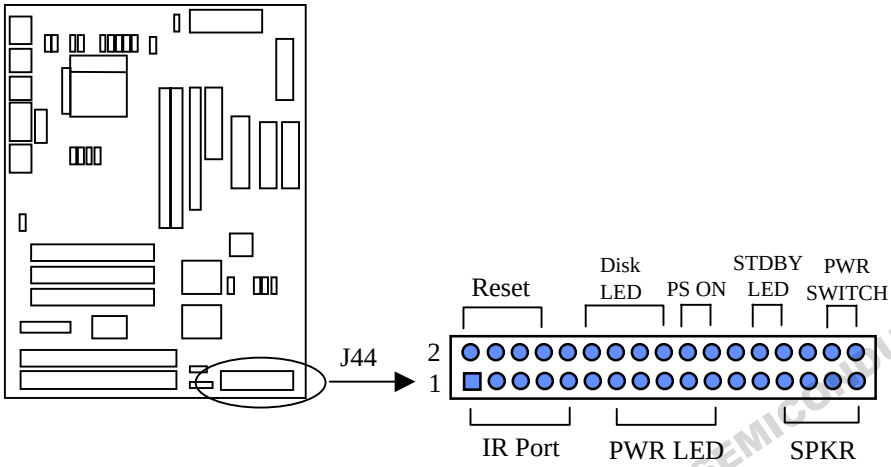
Pin	Signal	Pin	Signal
1	F_EJECT#	2	DENSEL
3	KEY	4	MSEN0
5	Gnd	6	DISK CHANGE#
7	Gnd	8	INDEX#
9	Gnd	10	MTR0#
11	Gnd	12	DRVSEL1#
13	Gnd	14	DRVSEL0#
15	Gnd	16	MTR1#
17	Gnd	18	DIR#
19	Gnd	20	STEP#
21	Gnd	22	WDATA#
23	Gnd	24	WGATE#
25	Gnd	26	TRK0#
27	Gnd	28	WRTPRT#
29	Gnd	30	RDATA#
31	Gnd	32	HDSEL#
33	Gnd	34	PULL UP

5.3.2.7 CMOS Battery Connector (J2)



Connect the CMOS battery connector to 1-4

5.3.2.8 Misc. Connectors (J44)



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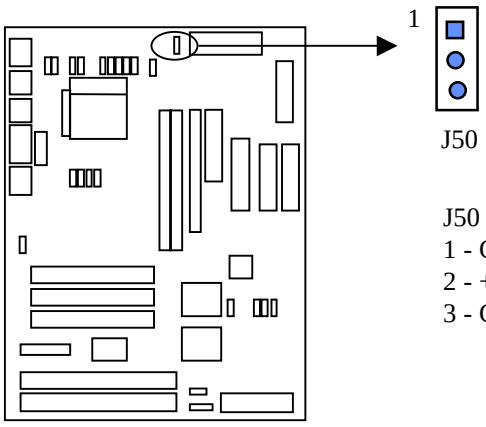
The following are the pin assignment for J44:

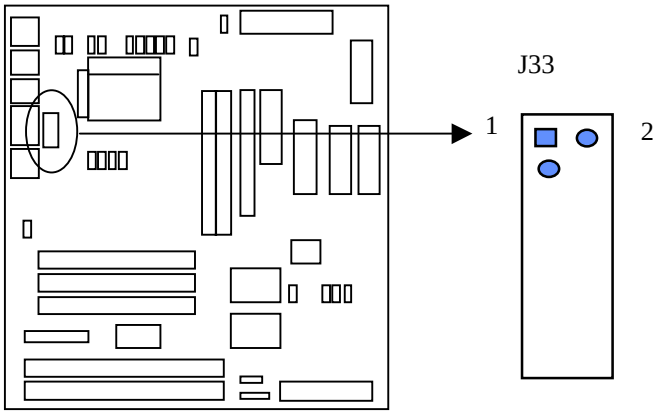
Pin	Signal	Pin	Signal
1	VCC	2	GND
3	NC	4	RSTHDR#
5	IRRX	6	GND
7	GND	8	NC
9	IRTX	10	NC
11	NC	12	VCC
13	VCC	14	DISKLED#
15	NC	16	DISKLED#
17	GND	18	VCC
19	NC	20	PS_ON#
21	GND	22	GND
23	NC	24	NC
25	NC	26	VSTDBY
27	PCSPKR	28	GND
29	NC	30	NC
31	GND	32	PWR_A
33	VCC	34	PWR_B

5.3.2.9 CPU Fan Power Connector (3-pin)



J50 CPU FAN POWER
1 - GND
2 - +12V
3 - GND

5.3.2.10 ESP Connector (J33)



The following is the pin assignment for the ESP port:

Pin	Signal	Pin	Signal
1	TDO	2	NC
3	TDI	4	TRST
5	NC	6	ESPSENSE
7	TCK	8	NC
9	TMS	10	NC
11	SRST	12	NC
13	HRST	14	KEY
15	CKSTPO	16	GND

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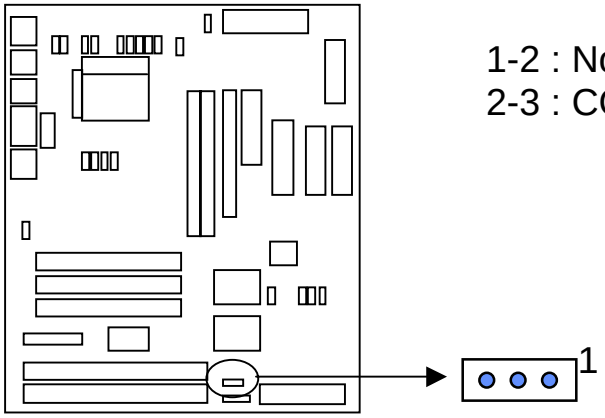
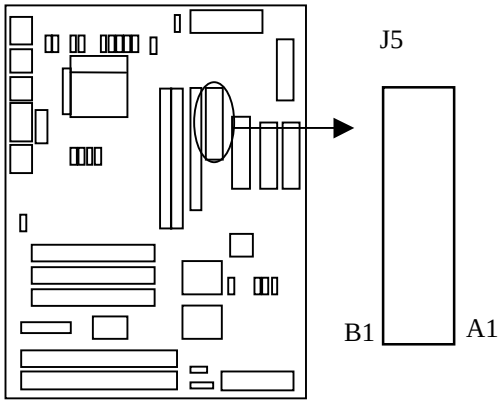
This ESP port works with JTAG, COP or Riscwatch Emulator . There is a KEY position in pin 14. Make sure the key position matches with the Emulator connector. HP/Corelis/RiscWatch Emulator requires QACK to pull low in order to use the soft stop CPU function. Please make sure jumper installed on 2-3 of J39.



1-2 : Normal
2-3 : COP Mode

5.3.2.11 VRM Connector



Pin	Signal	Pin	Signal
A1	GND	B1	GND
A2	GND	B2	GND
A3	+3.3V	B3	+3.3V
A4	+3.3V	B4	+3.3V
A5	VCC	B5	VCC
A6	VCC	B6	VCC
A7	VID4	B7	VID2
A8	VID3	B8	VID1
A9	VID0	B9	+12V
A10	GND	B10	GND
A11	GND	B11	GND
A12	NC	B12	NC
A13	IVDD	B13	IVDD
A14	IVDD	B14	IVDD
A15	IVDD	B15	IVDD

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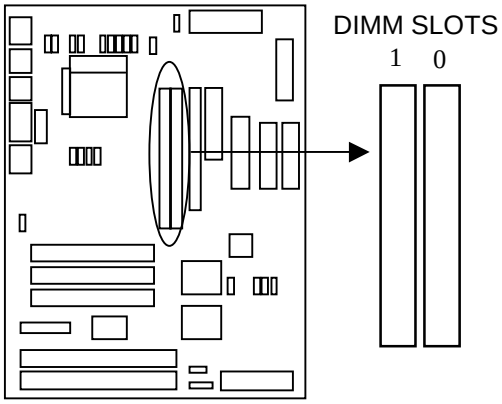
5.3.3 EXPANSION SLOTS

5.3.3.1 DRAM DIMM Slots



Yellowknife supports SDRAM DIMMs.
With two 64-bit (168-pin) DIMM sockets (labeled 0 and 1), Yellowknife supports from 16MB to 128MB of system memory using DIMM with various densities.

Please refer to the MPC106 user's manual and hardware specification for DRAM timings. Currently, Yellowknife is shipped with 32MB of 100MHz SDRAM module.

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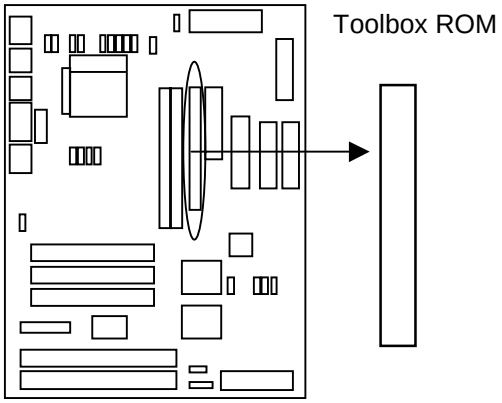
5.3.3.2 ROM

There are 2 ROMs on the Yellowknife motherboard. The first ROM is the TOOLBOX ROM that is mainly for testing purpose . The second ROM is the boot ROM that supports DINK32 .

5.3.3.2.1 Toolbox ROM (For testing purpose)

There is a ROM DIMM socket on the motherboard. The size of the Toolbox ROM is 4 MB and this ROM is located on the Local 60X-memory bus.



The Toolbox ROM socket is 160 pins and the pin assignment is as follows:

Pin	Signal	Pin	Signal
81	+5V	1	+5V
82	GND	2	GND
83	+12V	3	+12V
84	MDL31	4	MDH31
85	MDL30	5	MDH30
86	MDL29	6	MDH29
87	MDL28	7	MDH28
88	NC	8	NC
89	+5V	9	+5V
90	NC	10	NC
91	MDL27	11	MDH27
92	MDL26	12	MDH26
93	MDL25	13	MDH25
94	MDL24	14	MDH24
95	GND	15	GND
96	MDL23	16	MDH23
97	MDL22	17	MDH22
98	MDL21	18	MDH21
99	MDL20	19	MDH20
100	NC	20	NC
101	+5V	21	+5V
102	NC	22	NC
103	MDL19	23	MDH19
104	MDL18	24	MDH18
105	MDL17	25	MDH17
106	MDL16	26	MDH16
107	GND	27	GND
108	ROMA19	28	NC
109	ROMA18	29	NC
110	NC	30	ROMA17
111	ROMA16	31	ROMA15
112	ROMA14	32	ROMA13
113	ROMA12	33	ROMA11
114	ROMA10	34	ROMA09
115	RCS1#	35	NC
116	ROM_PRESENT	36	NC
117	ROMWE#	37	ROMWE#
118	FOE#	38	ROMOE#
119	NC	39	NC
120	NC	40	NC

Pin	Signal	Pin	Signal
121	+5V	41	+5V
122	NC	42	NC
123	GND	43	GND
124	ROMA08	44	ROMA07
125	ROMA06	45	ROMA05
126	ROMA04	46	ROMA03
127	ROMA02	47	ROMA01
128	ROMA00	48	NC
129	NC	49	NC
130	NC	50	NC
131	NC	51	NC
132	NC	52	NC
133	GND	53	GND
134	MDL15	54	MDH15
135	MDL14	55	MDH14
136	MDL13	56	MDH13
137	MDL12	57	MDH12
138	NC	58	NC
139	+5V	59	+5V
140	NC	60	NC
141	MDL11	61	MDH11
142	MDL10	62	MDH10
143	MDL09	63	MDH09
144	MDL08	64	MDH08
145	GND	65	GND
146	MDL07	66	MDH07
147	MDL06	67	MDH06

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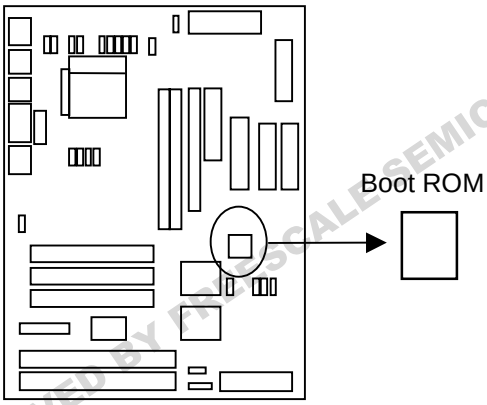
148	MDL05	68	MDH05
149	MDL04	69	MDH04
150	NC	70	NC
151	+5V	71	+5V
152	NC	72	NC
153	MDL03	73	MDH03
154	MDL02	74	MDH02
155	MDL01	75	MDH01
156	MDL00	76	MDH00
157	GND	77	GND
158	NC	78	NC
159	NC	79	NC
160	+5V	80	+5V

5.3.3.2.2 Boot ROM



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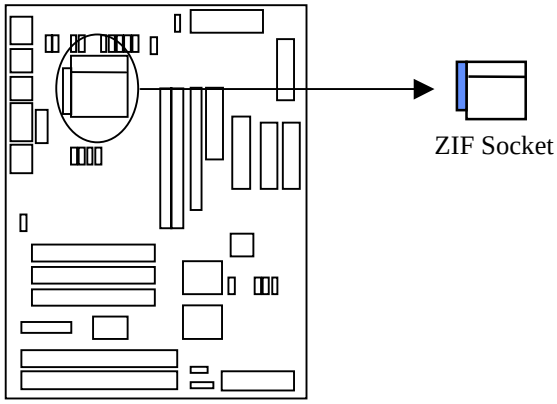
Yellowknife incorporates a boot ROM which is implemented as a 4Mb (512Kbx8) flash EPROM.

The bootROM contains the DINK boot code to support basic debug function. See DINK user's manual for more information.

The boot ROM is physically located on the ISA bus.

5.3.3.3 PowerPC Processor socket



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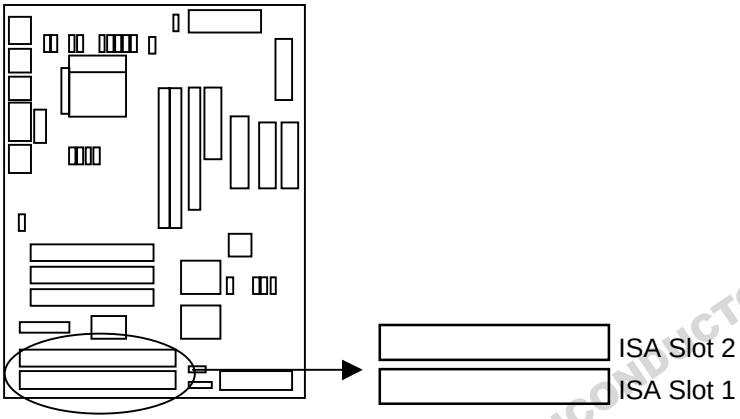
Yellowknife supports all 1.8V-3.3V 6xx and 7xx PowerPC processors operating in modes that result in external processor bus speeds up to 100 MHz. Voltage regulator module is used to provide different voltage for different processor. There is one socket 3 PGA ZIF socket on board. Socket 3 is a 17 X 17 fully populated footprint. A BGA to PGA interposer will be used to convert the BGA footprint to the PGA footprint.

Pin Assignment for the 17 x 17 array (Top View)

	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
U	MPINT	DL15	DH3	DH5	DL20	DL22	DH9	DH11	DH12	DH17	DH19	DH23	DH27	DH29	DL31	PID1	PID0	U
T	MPCLK	OVDD	DH2	GND	DL18	OVDD	DH8	GND	DH13	GND	DH22	OVDD	DH28	GND	DL28	OVDD	DL27	T
R	DL11	DL14	DBG2	DL16	DH4	DL19	DL21	DH10	DH16	DH18	DH24	DH25	DH30	DL29	PID2	DL26	DP6	R
P	DL10	GND	DL13	OVDD	DH0	GND	DH7	OVDD	DH15	OVDD	DH21	GND	DL30	OVDD	DL24	GND	DP4	P
N	DL4	DL6	DL9	DL12	NC	DH1	DL17	DH6	DH14	DH20	DH26	DL31	QREQ	DL25	DL23	DP3	DP1	N
M	DL2	OVDD	DL5	GND	DL8	GND	VDD	GND	OVDD	GND	VDD	GND	DP7	GND	DP2	OVDD	A31	M
L	DBB	DL0	TS	DL3	DL7	VDD	GND	VDD	GND	VDD	GND	VDD	DP5	DP0	ABB	SHD	A29	L
K	XATS	GND	DL1	OVDD	A30	GND	VDD	GND	VDD	GND	VDD	GND	ATRY	OVDD	AACK	GND	DBG	K
J	DTRY	TA	DBDI	TEA	A28	OVDD	GND	VDD	GND	VDD	GND	OVDD	BG	DBWO	A27	A25	A21	J
H	A26	GND	A24	OVDD	A22	GND	VDD	GND	VDD	GND	VDD	GND	A23	OVDD	A19	GND	A17	H
G	A20	A18	A16	A14	A10	VDD	GND	VDD	GND	VDD	GND	VDD	A7	A9	A11	A13	A15	G
F	A12	OVDD	A8	GND	A0	GND	VDD	GND	OVDD	GND	VDD	GND	GBL	GND	A3	OVDD	A5	F
E	A6	A4	TT4	INT	BG2	TBST	TSZ0	L2CK	CHKO	BR	CSE0	AP0	QACK	TBEN	DRV0	CI	A1	E
D	A2	GND	MCP	OVDD	SRST	GND	LSSD	OVDD	HALT	OVDD	NAPR	GND	RSRV	OVDD	DRV1	GND	WT	D
C	TT3	TT2	TLBI	TT1	TMS	TCK	PLL3	SYSC	CKST	APE	TC2	TC0	AP2	AP1	VID4	VID1	SDATA	C
B	SMI	OVDD	TSZ2	GND	TDI	OVDD	L1CL	GND	HRST	GND	DPE	OVDD	CSE1	GND	VID3	OVDD	VID0	B
A	BR2	TT0	TSZ1	TD0	PLL2	TRST	AVDD	PLL1	PLL0	ARAY	L2INT	CLK0	TC1	AP3	SCLK	VID2		A
	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

5.3.3.4 ISA slots



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Yellowknife has two ISA slots (ISA1, and ISA2). The connectors, pin assignments, signal timings, loadings and mechanical dimensions all conform to the standard ISA specification. The pin assignment for the ISA connectors is as follows:

Pin	Description	Pin	Description
B1	GROUND	A1	IOCHK*
B2	RESETDRV	A2	SD7
B3	+5V	A3	SD6
B4	IRQ9	A4	SD5
B5	-5V	A5	SD4
B6	DRQ2	A6	SD3
B7	-12V	A7	SD2
B8	NOWS*	A8	SD1
B9	+12V	A9	SD0
B10	GROUND	A10	IOCHRDY
B11	SMEMW*	A11	AEN
B12	SMEMR*	A12	SA19
B13	IOW*	A13	SA18
B14	IOR*	A14	SA17
B15	DACK3*	A15	SA16
B16	DRQ3	A16	SA15
B17	DACK1*	A17	SA14
B18	DRQ1	A18	SA13
B19	REFRESH*	A19	SA12
B20	SYSCLK	A20	SA11
B21	IRQ7	A21	SA10
B22	IRQ6	A22	SA9
B23	IRQ5	A23	SA8
B24	IRQ4	A24	SA7
B25	IRQ3	A25	SA6
B26	DACK2*	A26	SA5
B27	T/C	A27	SA4
B28	BALE	A28	SA3
B29	+5V	A29	SA2
B30	OSC	A30	SA1
B31	GROUND	A31	SA0
D1	MEMCS16*	C1	SBHE*
D2	IOCS16*	C2	LA23
D3	IRQ10	C3	LA22
D4	IRQ11	C4	LA21
D5	IRQ12	C5	LA20
D6	IRQ15	C6	LA19
D7	IRQ14	C7	LA18
D8	DACK0*	C8	LA17
D9	DRQ0	C9	MEMR*
D10	DACK5*	C10	MEMW*
D11	DRQ5	C11	SD8
D12	DACK6*	C12	SD9
D13	DRQ6	C13	SD10
D14	DACK7*	C14	SD11

D15	DRQ7	C15	SD12
D16	+5V	C16	SD13
D17	MASTER*	C17	SD14
D18	GROUND	C18	SD15

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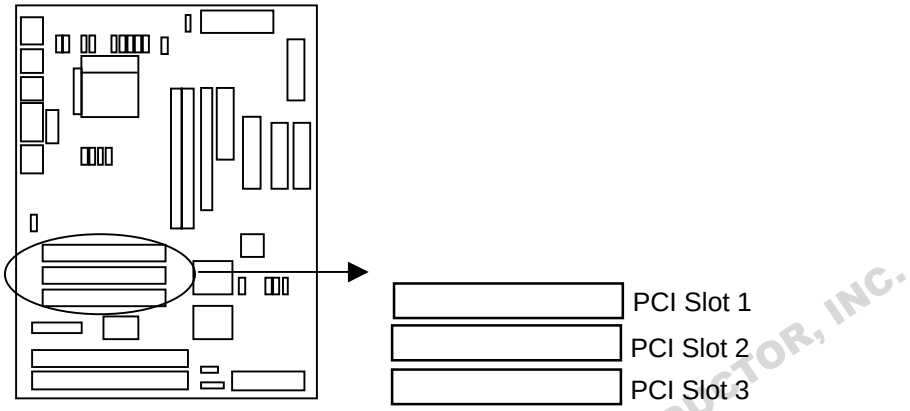
5.3.3.5 PCI Slots



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Yellowknife has three PCI slots (PCI 1, PCI 2 and PCI 3). The connectors, pin assignments, signal timings, loadings and mechanical dimensions all conform to the standard PCI specification. The PCI bus runs at either 30 MHz or 33 MHz as determined by the (external) processor speed. See section 5.3 for details. The pin assignment for the PCI connectors is as follows:

Pin	Description	Pin	Description
B1	-12V	A1	TRST*
B2	TCK	A2	+12V
B3	GROUND	A3	TMS
B4	TD0	A4	TDI
B5	+5V	A5	+5V
B6	+5V	A6	INTA*
B7	INTB*	A7	INTC*
B8	INTD*	A8	+5V
B9	PRSNT1*	A9	RESERVED
B10	RESERVED	A10	+5V
B11	PRSNT2*	A11	RESERVED
B12	GROUND	A12	GROUND
B13	GROUND	A13	GROUND
B14	RESERVED	A14	RESERVED
B15	GROUND	A15	RST*
B16	CLK	A16	+5V (I/O)
B17	GROUND	A17	GNT*
B18	REQ*	A18	GROUND
B19	+5V (I/O)	A19	RESERVED
B20	AD31	A20	AD30
B21	AD29	A21	+3.3V
B22	GROUND	A22	AD28
B23	AD27	A23	AD26
B24	AD25	A24	GROUND
B25	+3.3V	A25	AD24
B26	C/BE*3	A26	IDSEL
B27	AD23	A27	+3.3V
B28	GROUND	A28	AD22
B29	AD21	A29	AD20
B30	AD19	A30	GROUND
B31	+3.3V	A31	AD18
B32	AD17	A32	AD16
B33	C/BE*2	A33	+3.3V
B34	GROUND	A34	FRAME*
B35	IRDY*	A35	GROUND
B36	+3.3V	A36	TRDY*
B37	DEVSEL*	A37	GROUND
B38	GROUND	A38	STOP*
B39	LOCK*	A39	+3.3V
B40	PERR*	A40	SDONE
B41	+3.3V	A41	SBO*
B42	SERR*	A42	GROUND
B43	+3.3V	A43	PAR
B44	C/BE*1	A44	AD15
B45	AD14	A45	+3.3V
B46	GROUND	A46	AD13

B47	AD12	A47	AD11
B48	AD10	A48	GROUND
B49	GROUND	A49	AD9
B50	(KEY)	A50	(KEY)
B51	(KEY)	A51	(KEY)
B52	AD8	A52	C/BE*0
B53	AD7	A53	+3.3V
B54	+3.3V	A54	AD6
B55	AD5	A55	AD4
B56	AD3	A56	GROUND
B57	GROUND	A57	AD2
B58	AD1	A58	AD0
B59	+5V (I/O)	A59	+5V (I/O)
B60	ACK64*	A60	REQ64*
B61	+5V	A61	+5V
B62	+5V	A62	+5V

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6 HARDWARE

6.1 PROCESSOR SPEED SUPPORT

Six sets of jumpers will be located on board which are set to specify:

- external CPU bus speed (50, 60, 66, 75, 83, 100 MHz)
- processor clock PLL setting (2x, 2.5x, 3x, 3.5x , 4x, 4.5x ,5x, 5,5x, 6x).

The following table lists some examples of the processor core speed Vs external processor bus speed:

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PLL Setting	Frequency (MHz)		**J35**	**J36**	**J38**	**J40**
	Core	Bus	PLL0	PLL1	PLL2	PLL3
2x	180 **200**	90 **100**	0 **IN**	1 **OUT**	0 **IN**	0 **OUT**
2.5X	188 **200** 225 250	75 **83** 90 100	0 **IN**	1 **OUT**	1 **OUT**	0 **IN**
3x	180 200 225 250 270 300	60 66 75 83 90 100	1 **OUT**	0 **IN**	0 **IN**	0 **IN**
3.5x	210 233 262 290 315 350	60 66 75 83 90 100	1 **OUT**	1 **OUT**	1 **OUT**	0 **IN**
4x	200 240 266 300 332	50 60 66 75 83	1 **OUT**	0 **IN**	1 **OUT**	0 **IN**
4.5x	225 270 300	50 60 66	0 **IN**	1 **OUT**	1 **OUT**	1 **OUT**
5x	250 300 333	50 60 66	1 **OUT**	0 **IN**	1 **OUT**	1 **OUT**
5.5x	275 300	50 60	1 **OUT**	0 **IN**	1 **OUT**	0 **IN**
6x	300	50	1 **OUT**	1 **OUT**	0 **IN**	1 **OUT**

6.2 SYSTEM BUS AND PCI BUS CONTROL

Seven jumpers used to define the speed of the system bus and the PCI bus. J61, J34

The following table lists all the system and PCI bus speed and the jumper's settings:

Bus Speed (MHz)		J61	J34	J32	J57	J59	J58	J60
System	PCI				GPLL0	GPLL1	GPLL2	GPLL3
50	25	0	0	0	0	1	0	1
60	30	0	0	1	0	1	0	0
66	33	0	1	0	0	1	0	0
75	37	0	1	1	0	1	0	0
83	33	1	0	0	0	1	1	0
90	36	1	0	1	0	1	1	0
100	40	1	0	1	0	1	1	0
100	33	1	0	1	1	0	0	0

0 = Jumper Installed
1 = Jumper Not Installed

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6.3 VOLTAGE REGULATOR MODULE (VRM)

The RCB010 from Raytheon Electronics is a programmable DC-DC Voltage Regulator Module designed to deliver the selectable processor core voltage required by the PowerPC processor. The RCB010 takes full advantage of a Raytheon programmable DC-DC controller IC. This IC integrates a 5-bit DAC for automatic output programmability without the need for external precision resistors. The RCB010 provides an extremely well regulated selectable output voltage from 1.3V to 3.5V. Output voltage selection is accomplished through a 5-bit interface between the processor interposer and the module connector.
The VID selections are done on the interposer. Do not populate J45,J46, J47, J55 and J56 unless you are instructed by a Motorola field application engineer.

The following are the output voltage programming codes:

VID4	VID3	VID2	VID1	VID0	VOLTAGE
0	1	1	1	1	1.3V
0	1	1	1	0	1.35V
0	1	1	0	1	1.4V
0	1	1	0	0	1.45V
0	1	0	1	1	1.5V
0	1	0	1	0	1.55V
0	1	0	0	1	1.6V
0	1	0	0	0	1.65V
0	0	1	1	1	1.7V
0	0	1	1	0	1.75V
0	0	1	0	1	1.8V
0	0	1	0	0	1.85V
0	0	0	1	1	1.9V
0	0	0	1	0	1,95V
0	0	0	0	1	2V
0	0	0	0	0	2.05V
1	1	1	1	0	2.1V
1	1	1	0	1	2.2V

1	1	1	0	0	2.3V
1	1	0	1	1	2.4V
1	1	0	1	0	2.5V
1	1	0	0	1	2.6V
1	1	0	0	0	2.7V
1	0	1	1	1	2.8V
1	0	1	1	0	2.9V
1	0	1	0	1	3.0V
1	0	1	0	0	3.1V
1	0	0	1	1	3.2V
1	0	0	1	0	3.3V
1	0	0	0	1	3.4V
1	0	0	0	0	3.5V

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6.4 RTC AND NVRAM

Yellowknife incorporates an 8-KB battery-backed SRAM that is organized as 8Kbx8 and is used for the storage of system configuration information such as:

- Boot record
- Global environment parameters
- Language data
-

The RTC is located inside the National Super I/O chip.

6.5 DISPLAY

Yellowknife communicate with the terminal through serial port 1, the terminal needs to be VT-100 compatible.

6.6 DISK DRIVES

6.6.1 IDE Drive(s)

Yellowknife includes logic for a PCI Bus Master IDE Interface. Two connectors are located on the motherboard to support the primary and secondary interface.

6.6.2 Hard Drive Activity Indicator

The Yellowknife chassis incorporates a hard disk drive activity indicator, which is ON when data is being, transferred to/from any internal IDE drive.

6.6.3 Floppy Drive(s)

Yellowknife supports 3.5" standard PC floppy disk drive.

6.7 SPEAKER

A PC-type 2.5"--diameter speaker is mounted on the inside of the chassis.

6.8 POWER SUPPLY

Yellowknife incorporates a ATX format 250W PC-type power supply capable of supplying sufficient power at all required voltages to meet the needs of the supported motherboard, drives and add-in cards.

The power supply is switchable externally between 100V/60Hz and 220V/50Hz operations.

6.9 KEY COMPONENTS

The following table summarizes the key components used in the Yellowknife system:

Processor	603, 740 and 750 family
CPU-PCI Bridge	MPC106 (Grackle)
PCI-ISA Bridge	Winbond 83C553
I/O Controller	National Semi PC87308VUL
Enhanced IDE controller	Built in the PCI-ISA bridge
NVRAM (RTC)	Built in PC87308VUL
NVRAM (SRAM)	Sharp LH5168 (8k x 8)
Cache Tag RAMs	Motorola 27t416

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6.9.1 MPC106

The MPC106 is a single-chip bridge device providing access between the MPC6xx/MPC7xx processor and the PCI bus. The MPC106 also integrates a secondary cache controller and a high performance memory controller that supports EDO and SDRAM. The memory controllers also support EITHER ROM or Flash ROM. In the Yellowknife Design, up to 128 Mbytes of onboard SDRAM will be supported. The MPC106's processor interface module handles the processor transactions and performs snoop operations. This interface also provides the bus arbitration function between processors, one level of address pipelining, and address and data bus parking. The secondary cache controller supports 256 Kbytes to 1Mbyte of direct-mapped cache in write-through or write-back mode; either mode can be programmed through an internal configuration register.

6.9.2 Winbond 83C553

The Yellowknife system uses the Winbond 83C553 PCI-ISA controller as a bridge to the ISA bus. This bridge provides the following functions:

- 100% PCI and ISA compatible
- Incorporates two 8237 DMA controllers
- High performance PCI arbiter
- Incorporates two 8259 interrupt controllers
- One 82C54 16-bit counter/timer
- Bus master IDE support for 4 IDE devices

For more information on the Winbond chip, please refer to their user manual.

6.9.3 National Semiconductor PC87308VUL

The PC87308VUL is a single chip super I/O controller. It incorporates in one fully Plug and Play compatible chip, a Floppy Disk controller, a Keyboard and mouse controller, a Real-time clock, two full function UARTs, infrared support, a full IEEE 1284 parallel port, three general purpose chip select signals, and support for power management functions.
PC87308VUL also provide interface to the external SRAMs to provide the NVRAM functions.

7 DINK32 DEBUG MONITOR

Yellowknife embedded configuration is shipped with DINK32 boot firmware. DINK32 is a flexible software tool enabling evaluation and debugging of the PowerPC 32-bit microprocessor. DINK is designed to be both a hardware and software-debugging tool. DINK32 was written in ANSI C and built with modular routines around a central core. Only a few necessary functions were written in PowerPC assembly.

The DINK32 provides the following functions:

- Modification and display of general purpose, floating point, and special purpose registers
- Assembly and disassembly of PowerPC instructions for modification and display of code
- Single-step race and continued execution from a specified address
- Modification, display, and movement of system memory
- Setting, displaying and removing breakpoints
- Automatic decompression of compressed s-record files while downloading
- Extensive on-line help
- Ability to execute user-assembled and/or download software in a controlled environment
- Logging function for generating a transcript of a debugging session
- Two command sets for novice and experienced users

Please visit http://www.mot.com/SPS/PowerPC/teksupport/tools/DINK32/index.html for more information on Dink32.

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8 SOFTWARE

8.1 UTILITIES

Yellowknife embedded configuration is shipped with the following utility supplied on a floppy diskette:

- DINK32 diskette
  - contains Motorola S-Record files for supporting 603,740 and 750 families
  - All *.lst, *.s, *.h, *.c files

- Initialization code

  - The purpose of this code is to support initial bring-up or evaluation of Yellowknife platform. A "C" environment is established to enable driver and test routines are written in the "C" language.

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